

Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims

1. (Previously Presented) A closure device for closing an opening in a body cavity, comprising:
 - an elongate delivery member having a distal end and a proximal end;
 - a closure component removably connected to the distal end of the delivery member, the closure component including a collapsible backing movable between a non-collapsed delivery position, in which the backing has a generally conical shape with a center portion of the backing distally spaced from a periphery of the backing, and a collapsed deployed position, in which the backing center portion is collapsed proximally toward the backing periphery to have a generally disc shape, and a plurality of fibrous tissue engaging members disposed on the backing and oriented in a non-engaging orientation when traveling in a distal direction and in an engaging orientation when traveling in a proximal direction, the fibrous tissue engaging members entangling the backing when the backing is in the collapsed position; and
 - a collapse actuator releasably coupled to the collapsible backing, the actuator having a detachable distal end that is received within a distal aperture in the closure component and extends distal to the distal aperture when the closure component is in the non-collapsed position, the collapse actuator being operable to move the collapsible backing from the non-collapsed position to the collapsed position, and wherein the detachable distal end of the collapse actuator is configured to assume a deformed profile solely in response to a sufficient proximal force applied to the collapse actuator, the deformed profile permitting the detachable distal end to pass proximally through the distal aperture and thereby detach from the collapsed closure component.
2. (Previously Presented) The closure device of claim 1 wherein the backing is formed in a generally elongate conformation, along a generally longitudinal axis of the backing, in the non-collapsed position.

3. (Previously Presented) The closure device of claim 2 wherein the backing is collapsed generally along the longitudinal axis thereof when in the collapsed position.

4. (Original) The closure device of claim 3 wherein the fibrous tissue engaging members form proximally facing hooks.

5. (Original) The closure device of claim 4 wherein the proximally facing hooks are spaced along the backing from a proximal portion thereof to a distal portion thereof when the backing is in the non-collapsed position.

6. (Original) The closure device of claim 5 wherein the hooks entangle in the backing located proximal of the hooks as the backing moves from the non-collapsed position to the collapsed position.

7. (Original) The closure device of claim 4 wherein the body cavity is defined by generally smooth tissue and has fibrous tissue proximal thereof and wherein at least a subset of the plurality of hooks are oriented to engage the fibrous tissue as the hooks travel in a proximal direction relative to the fibrous tissue.

8. (Previously Presented) The closure device of claim 7 wherein the closure component has a first row of hooks disposed about the backing periphery.

9. (Original) The closure device of claim 8 wherein the first row of hooks passes along the generally smooth tissue without engaging the generally smooth tissue and engages the fibrous tissue as the closure component is moved proximally relative thereto.

10. (Previously Presented) The closure device of claim 4 wherein the closure component has a first row of hooks disposed about a proximal end thereof and wherein the first row of hooks includes tissue piercing hooks that pierce tissue as they are moved proximally relative thereto.

11. (Withdrawn) The closure device of claim 4 wherein the backing comprises a resilient web stretched over a distal support structure on the elongate delivery member.

12. (Withdrawn) The closure device of claim 4 wherein the backing forms a cone with collapsible rings, spaced from one another along the longitudinal axis thereof when in the non-collapsed position and generally collapsed relative to one another along the longitudinal axis thereof when in the collapsed position.

13. (Previously Presented) The closure device of claim 1 and further comprising:

an active actuator having a distal engaging end disconnectably connecting the closure component to the delivery member and a proximal end receiving an actuation input and actuating the distal engaging end to release the closure component in response to the actuation input.

14. (Withdrawn) The closure device of claim 1 wherein the backing generally forms a web having collapsible support members supporting the web in the non-collapsed position.

15. (Canceled).

16. (Previously Presented) The closure device of claim 1 wherein the detachable distal end of the collapse actuator is releasably coupled to a distal end of the closure component and is configured to move the distal end of the closure component under proximally directed force applied to the elongate member.

17. (Previously Presented) The closure device of claim 16 in which the detachable distal end of the collapse actuator includes a deformable hook for releasably coupling the collapse actuator to the closure component.

18. (Previously Presented) The closure device of claim 17 wherein the deformable hook is located distal of the distal aperture when the closure component is in the non-collapsed position.

19. (Previously Presented) The closure device of claim 18 wherein the deformable hook moves from a distal end of the closure component to a more proximal position to collapse the closure component under proximally directed force applied to the collapse actuator.

20. (Previously Presented) The closure device of claim 19 wherein the deformable hook deforms to pass through the distal aperture in the closure component after the closure component has moved to the collapsed position under continued application of proximally directed force on the collapse actuator.

21. (Previously Presented) The closure device of claim 16 wherein the collapse actuator comprises a wire.

22. (Original) The closure device of claim 21 wherein the wire comprises a frangible connection to the distal end of the closure component.

23. (Original) The closure device of claim 21 wherein the wire comprises a mechanically releasable connection to the distal end of the closure component.

24. (Original) The closure device of claim 1 wherein the closure component is formed of a biocompatible material.

25. (Original) The closure device of claim 1 wherein the closure component is formed of a bioabsorbable material.

26. (Previously Presented) A method of closing an opening in a body, comprising:

inserting distally through the opening a closure component having collapsible pile backing with pile engaging hooks and tissue engaging hooks disposed thereon, the pile backing initially have a non-collapsed delivery position in which the backing has a generally conical shape with a center portion of the backing distally spaced from a periphery of the backing;

withdrawing the closure component proximally relative to the opening such that the tissue engaging hooks engage tissue adjacent the opening;

applying proximally directed force to a collapse actuator releasably coupled to the collapsible pile backing and having a detachable distal end received within a distal aperture of the collapsible pile backing, the detachable distal end extending distal to the distal aperture, thereby to collapse the collapsible pile backing to a collapsed position in which the backing center portion is moved proximally toward the backing periphery to form a generally disc shape, and wherein the pile engaging hooks engage portions of the pile backing to retain the pile backing in the collapsed position; and

disconnecting the collapse actuator from the collapsible pile backing by applying additional proximally directed force on the collapse actuator, thereby causing the detachable distal end of the collapse actuator to assume a deformed profile solely in response to a sufficient proximal force applied to the collapse actuator, the deformed profile permitting the detachable distal end to pass proximally through the distal aperture and the collapsed pile backing.

27. (Original) The method of claim 26 wherein inserting comprises:

inserting the closure component with an elongate delivery member, the closure component being disposed at a distal end of the delivery member.

28. (Original) The method of claim 27 and further comprising:

disconnecting the closure component from the distal end of the delivery member.

29. (Original) The method of claim 28 wherein disconnecting comprises:

exerting proximally directed force on the delivery member after collapsing the collapsible pile.

30. (Canceled)

31. (Original) The method of claim 26 wherein the tissue engaging hooks are comprised of tissue piercing hooks that pierce the tissue when the tissue is engaged.

32. (Original) The method of claim 26 wherein the opening is in a body cavity defined by media and having adventitia adjacent thereto and wherein withdrawing comprises:

withdrawing the tissue engaging hooks proximally past the media to engage the adventitia.

33. (Previously Presented) A closure device for closing an opening in a body cavity, comprising:

an elongate delivery member having a distal end and a proximal end;
an implantable closure component disconnectably connected to the distal end of the delivery member, the closure component including a longitudinally collapsible backing movable between a non-collapsed delivery position, in which the backing has a generally conical shape with a center portion of the backing distally spaced from a periphery of the backing, and a collapsed deployed position, in which the backing center portion is collapsed proximally toward the backing periphery to have a generally disc shape, and a plurality of fibrous tissue engaging members on the backing and engaging the backing when the backing is in the collapsed position; and

a collapse actuator releasably coupled to the collapsible backing, the actuator having a detachable distal end that is received within a distal aperture in the closure component and extends distal to the distal aperture when the closure component is in the non-collapsed position, the collapse actuator being operable to move the collapsible backing from the non-collapsed position to the collapsed position, and wherein the detachable distal end of the collapse actuator is configured to assume a deformed profile

solely in response to a sufficient proximal force applied to the collapse actuator, the deformed profile permitting the detachable distal end to pass proximally through the distal aperture and thereby detach from the collapsed closure component.

34. (Original) The closure device of claim 33 wherein the fibrous tissue engaging members are oriented in a non-engaging orientation when traveling in a distal direction and in an engaging orientation when traveling in a proximal direction.

35. (Original) The closure device of claim 33 wherein the backing is formed in a generally elongate conformation, along a generally longitudinal axis of the backing, in the non-collapsed position.

36. (Original) The closure device of claim 33 wherein the fibrous tissue engaging members form proximally facing hooks.

37. (Original) The closure device of claim 36 wherein the proximally facing hooks are spaced along the backing from a proximal portion thereof to a distal portion thereof when the backing is in the non-collapsed position.

38. (Original) The closure device of claim 37 wherein the hooks entangle in the backing located proximal of the hooks as the backing moves from the non-collapsed position to the collapsed position.

39. (Original) The closure device of claim 38 wherein the body cavity is defined by generally smooth tissue and has fibrous tissue proximal thereof and wherein at least a subset of the plurality of hooks are oriented to engage the fibrous tissue as the hooks travel in a proximal direction relative to the fibrous tissue.

40. (Previously Presented) The closure device of claim 1 wherein the fibrous tissue engaging members and the backing are disposed on a same surface of the closure component.

41. (Previously Presented) The closure device of claim 40 wherein the same surface comprises an exterior surface of the closure component.